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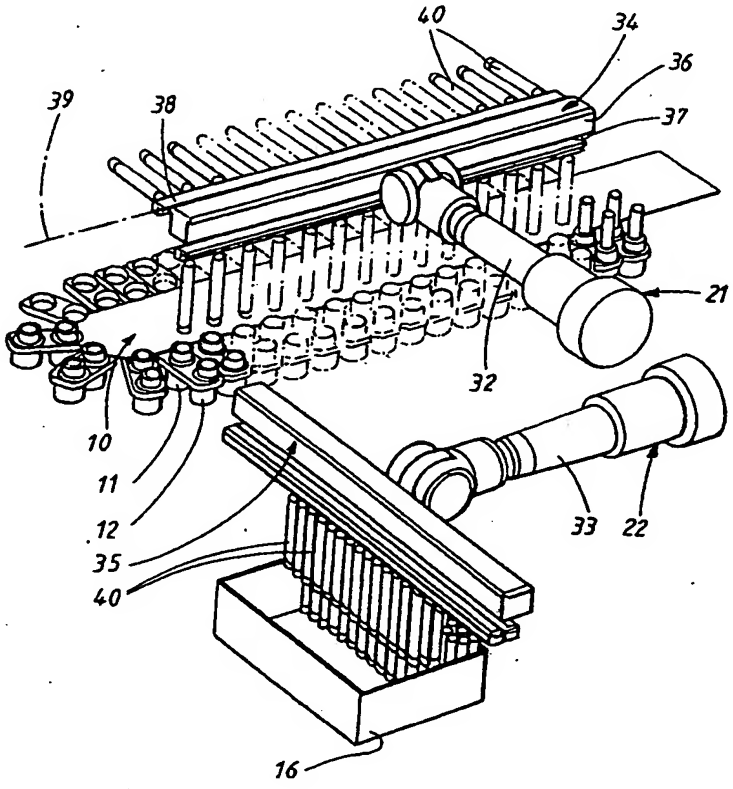
(54) Title: FEEDER FOR A TUBE–FILLING MACHINE

(57) Abstract

Feeder for a tube–filling machine of the type which, in a sequence of stations (28, 29, 30) along a continuous conveyor (10), is designed to process packaging tubes (40), including filling and sealing them, and where the conveyor has a straight section (10a) to which empty packaging tubes are taken from a magazine (13, 14) by means of at least one robot device (21, 22) and are inserted by the latter into tube holders (11, 12). The feeder is designed as a beam arrangement on the robot arm and comprises at least one elongate straight beam (37, 38) and a set of tube–handling members (41) arranged on the beam. Means are provided for positioning each tube–handling member in a first position specific for each such member and a second position specific for each such member along the beam. The distance between adjacent tube–handling members in the said first position is chosen such that it correponds to the spacing between the tube holders on the conveyor, and the distance in the said second position corresponds to the centre distance between adjacent tubes in the magazine.



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TITLE

Feeder for a tube-filling machine

The invention relates to machines/lines which, starting with empty packaging tubes, process these in the machine, including filling and sealing them, and output the tubes from the machine with high productivity/capacity.

More precisely, the invention relates to a feeder intended to constitute a principal component in such a high-production machine.

PRIOR ART

A number of different concepts have been proposed to increase the number of tubes produced per unit of time in a tube-filling line.

In practice, intermittently operating lines have for many years formed the basis for tube handling. Such lines are operationally reliable and can, within certain limits, be converted relatively easily to the actual requirements regarding production volumes, type of sealing, tube dimension, etc.

An advantageous type of intermittently operating machine is based on the principle of the continuous conveyor with two straight sections. Stations for processing the tubes are arranged along one straight section, and the other straight section is used for introducing empty tubes and in certain cases also for discharging filled tubes. The method of working, and the control, of the working tools in the processing stations can be arranged comparatively simply along a straight path. It is possible, for example, to freely adapt the length of the straight path so that a number of identical stations can simultaneously execute the same type of operation on a number of tubes, for example for sealing them. Such extension of the straight section and the provision of multiple stations increase the production volume.

Of course, the production volume per unit of time is also raised by increasing the speed of advance of the conveyor. However, this cannot be increased without restriction since the necessary time for processing in different stations imposes a limit. In addition, there are limits to what the arrangement will tolerate in terms of acceleration and deceleration.

A number of different concepts have been proposed in which, while retaining a partly intermittent operation of a tube-handling line, it has been attempted to increase the number of tubes produced per unit of time.

In such a concept, a continuously operating filling station has been chosen and this has been separated from the stations which are needed for subsequent processing of filled tubes. A traditional, intermittently operating conveyor has been used to convey the tubes to the subsequent processing stations once the tubes have been filled in the filler which is independent of the conveyor.

In this combination of continuous and intermittent operation, it has been proposed to use programmable robots on the one hand between the magazine for empty tubes and the filler, and on the other hand between the filler and the conveyor to the processing stations.

A problem in this context is that it has not been possible to find a simple, adaptable solution to the problem of transferring the tubes between magazine, filler and conveyor.

Also used as transfer arrangements/feeders in connection with tube fillers, especially for transferring empty tubes from a magazine to a conveyor, are feeders which operate on the principle of collecting a number of tubes from a magazine, placing these tubes on an arrangement, usually a conveyor, in order to separate the tubes, after which further arrangements are needed for turning the tubes through 90° so that these, with the correct mutual spacing,

can finally be pressed down into holders on the conveyor in the actual tube-filling machine.

In terms of their construction, the known feeders thus remain to a large extent tied to the machine, and there is very limited possibility of introducing such a feeder into an environment other than the one for which it was constructed.

OBJECT OF THE INVENTION

The object of the invention is to develop the robot concept in tube-handling lines and to provide an arrangement for a robot which makes available a tube feeder of high capacity and easy adaptability to the requirements set in terms of production volume and production line design.

THE INVENTION

The object of the invention is achieved with a feeder according to the preamble of attached Patent Claim 1, having the special features which are set out in the characterizing clause.

Advantageous developments of the invention are set out in the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will be described in greater detail below with reference to the attached drawings, in which:

Fig. 1 is a diagrammatic representation of the layout of a tube-handling line with feeders according to the invention,

Fig. 2 is a diagrammatic representation, in a perspective view, of two robots with feeders according to the invention, indicating the working method by which the feeders work in the line in Fig. 1,

Fig. 3 shows the arrangement from Fig. 2 at a slightly different angle,

Fig. 4 shows in greater detail the tube-handling members on the beam in the position for insertion, and the means used for positioning the tube-handling members, and

Fig. 5 shows the tube-handling members and the beam in position for collecting empty tubes.

ILLUSTRATIVE EMBODIMENT

Figure 1 shows a layout for a tube-handling machine with high production speed, up to 400-600 tubes per minute.

The machine has a continuous, intermittently operated conveyor 10 which is placed in the horizontal plane and which has two straight sections 10a, 10b and passes around deflector wheels 10c, 10d. Arranged along the conveyor there are double rows of tube holders 11, 12 (Fig. 2). Each pair of tube holders forms a unit, and in the embodiment shown each pair lies with its centre lines in a plane at right angles to the direction of transport, and with well-defined spacing (distance between the centre lines).

In the case in question, the intermittent operation is such that the conveyor advances in steps of a length of two spacings. Assuming that the machine is driven at 100 cycles per minute and that all the tube holders can be used, this gives a production capacity of 2 x 2 x 100 = 400 tubes per minute.

In the layout shown in Figure 1, there are double collection stations 13, 14 where empty tubes are picked up directly from among tubes arranged in ordered rows in transport packages 15, 16, and where the tubes are arranged with a predetermined centre distance. As soon as a transport package is empty, the next one is advanced to the respective collection station 13, 14 in the direction of the arrows 17, 18.

Empty transport packages are ejected in the direction of the arrows 19, 20.

Two programmable robots 21, 22 with feeders (which will be described later) in the form of beam arrangements 23, 24 collect empty tubes from the transport packages which are located in the collection stations and insert these tubes into the tube holders 11, 12 on the conveyor 10.

The work range of the robot 22 is shown diagrammatically by the broken line 25, and that of the robot 21 by the line 25'.

The tubes are thus inserted into the holders 11, 12 on the straight section 10a of the conveyor and are advanced by the said intermittent method in the direction of the arrows 26, 27.

Arranged along the semicircular section 10d of the conveyor there are stations (not shown) for tube cleaning and orientation of adornments. The tubes then arrive at a filling station 28 equipped with the necessary number of filling nozzles for the stepped advance in question, in the present case four filling nozzles.

Between the filling station 28 and a heat activation station 29 (for pre-heating of the tube ends), there is a section with devices (not shown) for identifying and ejecting faulty tubes.

After heat activation of the tubes in the station 29, these tubes arrive at a clamping and embossing station where the tube ends are finally sealed.

This is followed by an ejection station (not shown) for faulty tubes.

Filled and approved tubes are finally delivered in the direction of the arrows 30 to a delivery station and are transported in the direction of arrow 31 by means of a delivery conveyor.

Fig. 2 shows, in a simplified perspective view, the principle by which the feed robots 21, 22 work. On the arm of the robot 21 there is a beam arrangement 34 (the arrangement 23 in Fig. 1) which consists of a straight main beam 36 and two straight beam parts 37, 38 of essentially the same length as the main beam. The beam part 38 can be turned by means of a piston/cylinder arrangement (not shown) about an axis of rotation 39 parallel to the main beam 36. Like the other beam parts, the beam part 38 is provided with gripping devices 41 (Fig. 4) intended to grip the tubes 40 from the inside and carry these releasably on the respective beam. In Fig. 2, the beam part 38 is shown with the beam, and with the gripping devices 41 thereon, turned approximately 90° about the axis 39, from a position at right angles to the plane of the conveyor, which coincides with or is parallel to a plane at right angles to the vertical centre axes of the two rows of parallel tube holders.

On the beam part 38, in the same way as on the other beam parts, each gripping device 41 is supported by a holder plate 42 which in turn is supported slidably on a guide arrangement 43 which extends in the longitudinal direction of the beam. The holder plates are connected to each other by a belt 44 with a certain predetermined belt length between adjacent holder plates.

In one end position, the extent of the holder plates in the longitudinal direction of the guide arrangement defines a first, lesser centre distance

between the gripping members or devices 41 when the holder plates are driven to a position where they bear against each other. This first lesser centre distance is chosen such that it corresponds to the centre distance between adjacent tubes in rows of tubes in the transport packages in the feed stations 17 and 18, respectively.

In a second end position, the belt 44 defines a second, greater centre distance between the gripping devices 41 when the belt is fully stretched between adjacent holder plates 42. This second, greater centre distance corresponds to the spacing of (centre distance between) the tube holders 11, 12 on the conveyor.

The change-over of the holder plates 42 between the said first and second end positions is effected with the aid of a pair of piston/cylinder arrangements 45, 46 in which each extended piston rod end manoeuvres one of the outer holder plates 42 in the set of holder plates on the guide arrangement 43.

The rotational movement of the beam part 38 about the axis 39 is generated by a further piston/cylinder arrangement (not shown).

As can be seen from Figure 4, each gripping device 41 is divided in the longitudinal direction in order to permit pivoting, about a diametral axis in the base plane, of the parts which engage the inside of a tube. This pivoting of the parts of a gripping device is generated with a pneumatic cylinder arrangement 47 belonging to each grip device.

The robot 22 is identical to the robot 21 and has, on its robot arm, the same type of beam arrangement 35 as the robot 21.

In the operating stage shown in Fig. 2, the gripping devices 41 in both the beam sections on the robot 22 are driven together to the minimum centre

spacing and the robot arm 31 is in the process of lifting two rows of tubes out of the associated transport packages 15 and 16, respectively.

At the same time, the beam part 37 of the beam arrangement 24 on the robot 21 is in the process of lowering a set of tubes into the outer row of tube holders 12 on the conveyor.

The gripping devices 41 are here driven apart to the defined greater spacing determined by the belt 44.

After the set of tubes on the beam part has been pressed down into the holders 12 in the outer row of holders, the conveyor is advanced in steps of a number of spacings, in the present case two, at the same time as the beam part 38 is turned about its pivot axis 39 to a position in which the gripping devices 41 and the tubes 40 located thereon are oriented vertically. Thereafter, the set of tubes is pressed down into associated holders on the inner row of holders 11 as soon as the said stepped advance has been completed. After this, the robot arm 32 starts its return movement to the collection station 21.

The robot arm 33 of the robot 22 gradually works its way to the tube feed position with the holder plates 44 driven apart and with the beam part 38 turned to the position according to Fig. 2. During this period of time, the tube holders 11, 12 have been advanced sufficiently to permit insertion of the whole set of tubes on the gripping device 41 into tube holders following directly on those in which tubes have already been inserted during the previous stage (by means of the robot 21).

At start-up, manual assistance may be needed for the feed. The reason for this is that on the conveyor side 10b where the processing stations are located, there should at all times be tubes in all the tube holders, and in particular in the first ones, before processing is started up.

Although the invention has been described in connection with double rows of tube holders, it will be appreciated that the feeder device according to the invention is not limited to this, and instead it can be applied in general and by means of its basic construction can be easily modified to the requirements in question. The invention is thus limited only by what is stated in the attached patent claims.

PATENT CLAIMS

1. Feeder for a tube-filling machine which, in a sequence of stations along a continuous conveyor (10) provided with tube holders, is designed to process packaging tubes (40), including filling and sealing them, and where the conveyor has a straight section (10a) to which empty packaging tubes are taken from a magazine (13, 14) by means of at least one robot device (21, 22) and are inserted by the latter into tube holders (11, 12), which have a predetermined mutual spacing on the conveyor greater than the centre distance between adjacent tubes in the magazine, characterized in that the said at least one robot has an arm (32, 33) provided with a beam arrangement (34, 35) comprising at least one elongate straight beam (37, 38), in that a set of tube-handling members (41) is arranged on the beam, in that means (45, 46) are provided for positioning each tube-handling member in a first position specific for each such member and a second position specific for each such member along the beam, and in that the distance between adjacent tube-handling members in the said first positions corresponds to the spacing between the tube holders (11, 12) on the conveyor, and the distance in the said second positions corresponds to the centre distance between adjacent tubes in the magazine (13, 14).

2. Feeder according to Claim 1, characterized in that the said beam arrangement comprises two elongate, straight and essentially parallel beams (37, 38), each one provided with a set of tube-handling members (41), and in that means are provided for turning at least one of the beams about its longitudinal axis (39).

3. Feeder according to Claim 2, characterized in that the said tube-handling members are members (41) gripping the tubes from the inside.

4. Tube-handling line equipped with a feeder according to one or more of the preceding claims, characterized in that two robots (21, 22) are

arranged between the said magazine (13, 14) and the said straight section (10a), and in that the robots are programmed to alternately collect tubes, with the feeders, from the magazine and transfer the tubes, with the feeders, and insert them into the tube holders (11, 12).

5. Tube-handling line according to Claim 4, characterized in that the conveyor (10) has double rows of tube holders (11, 12), and in that each feeder has two beam parts (37, 38), each with its own set of tube-handling members (41), the first set of tube-handling members being arranged to insert tubes into the first row of tube holders, and the second set of tube-handling members being arranged to insert tubes into the second row of tube holders.

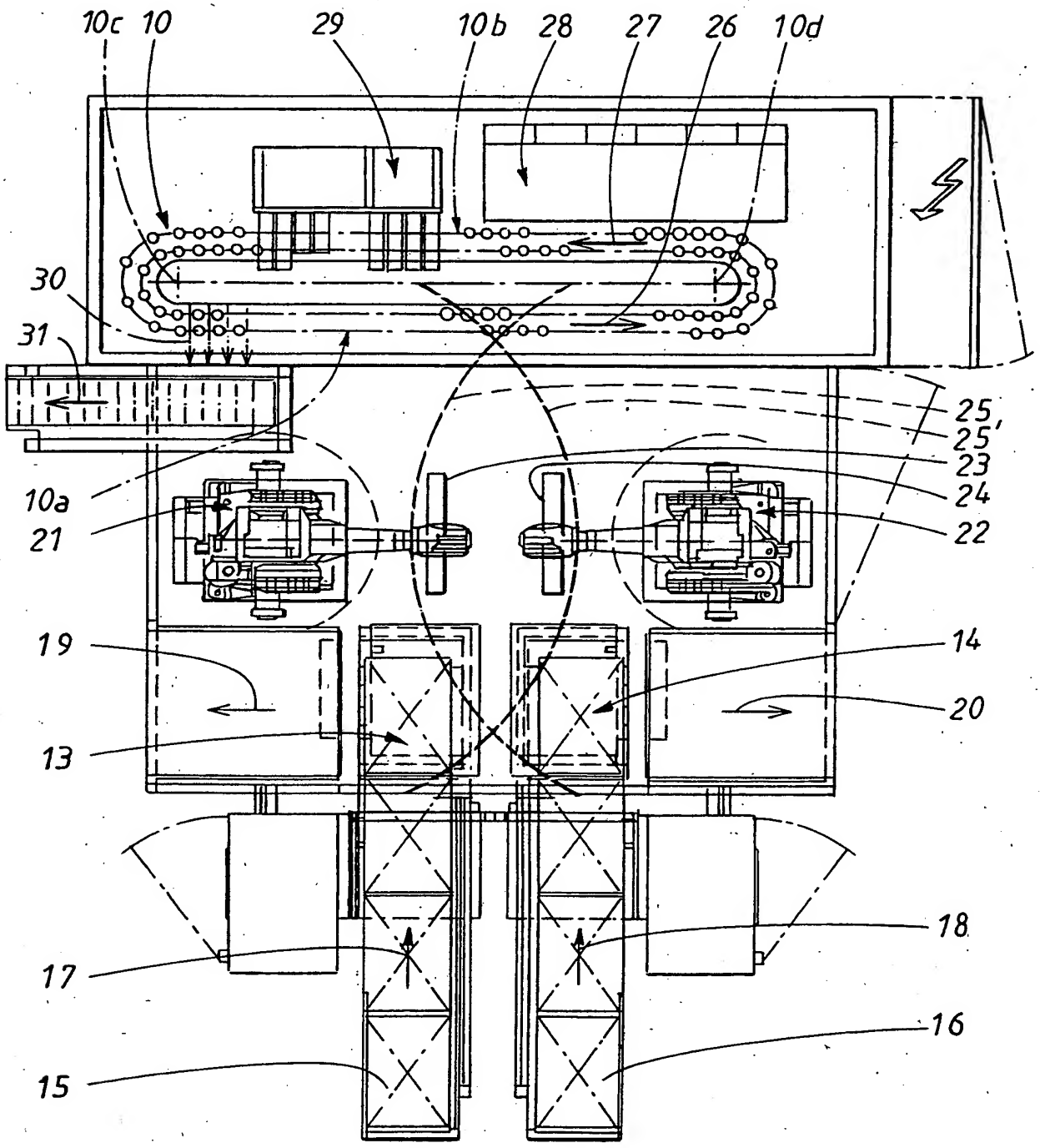
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FIG. 1

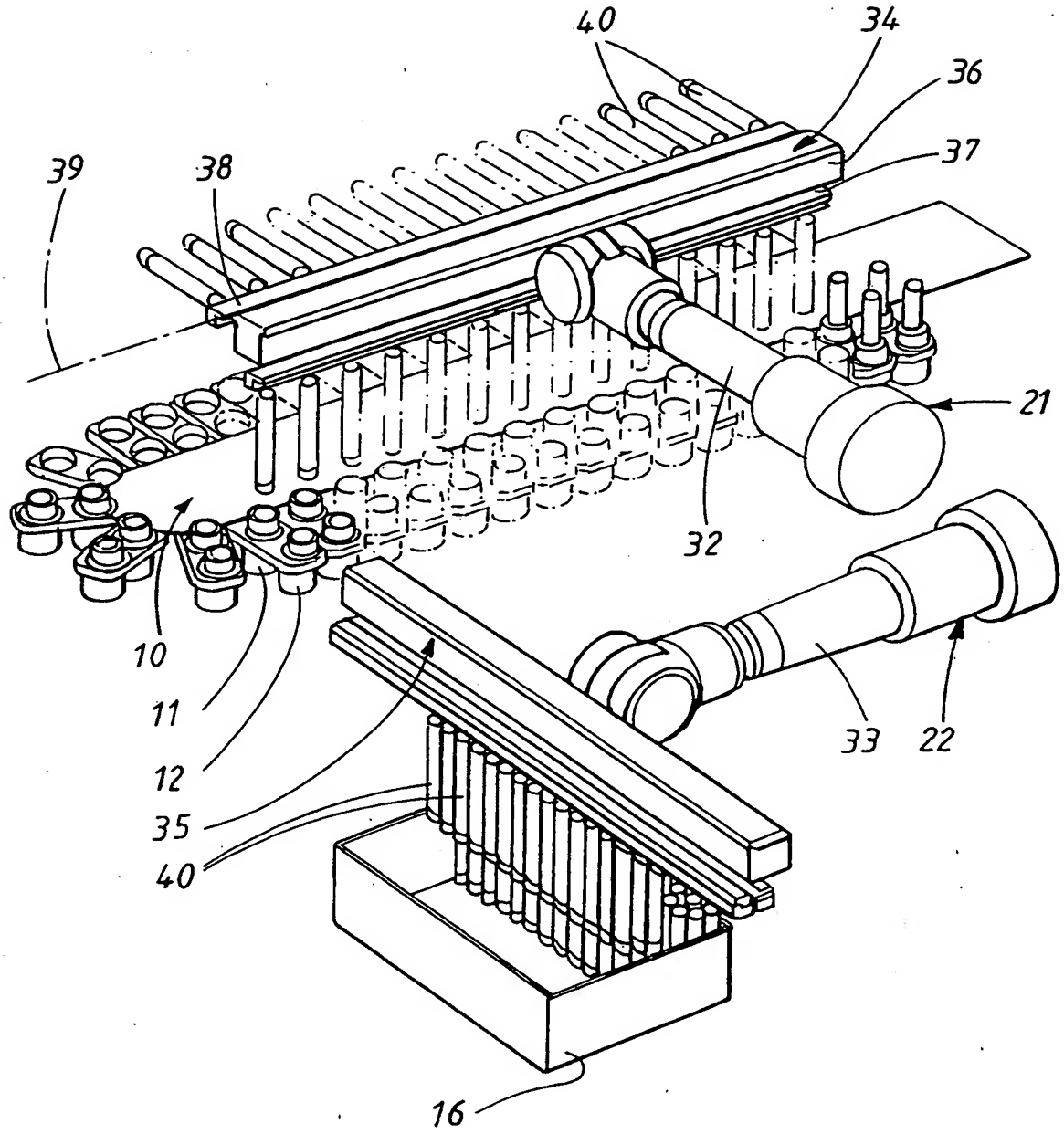

FIG. 2

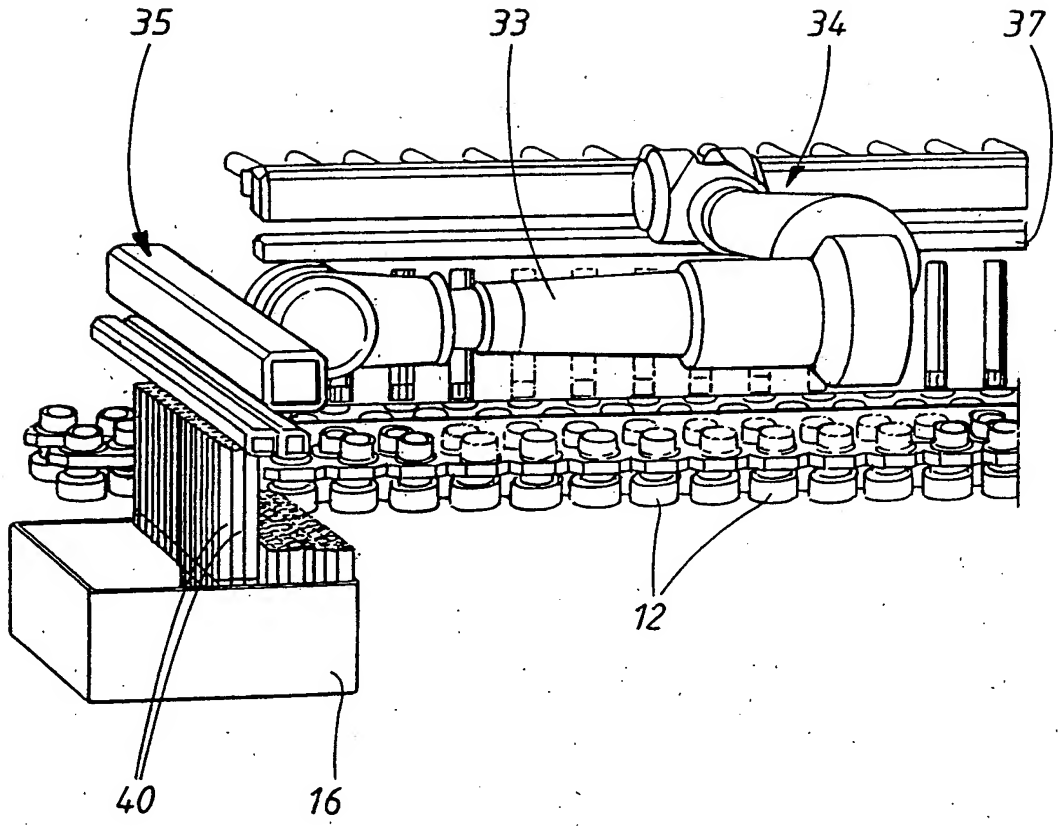

FIG. 3

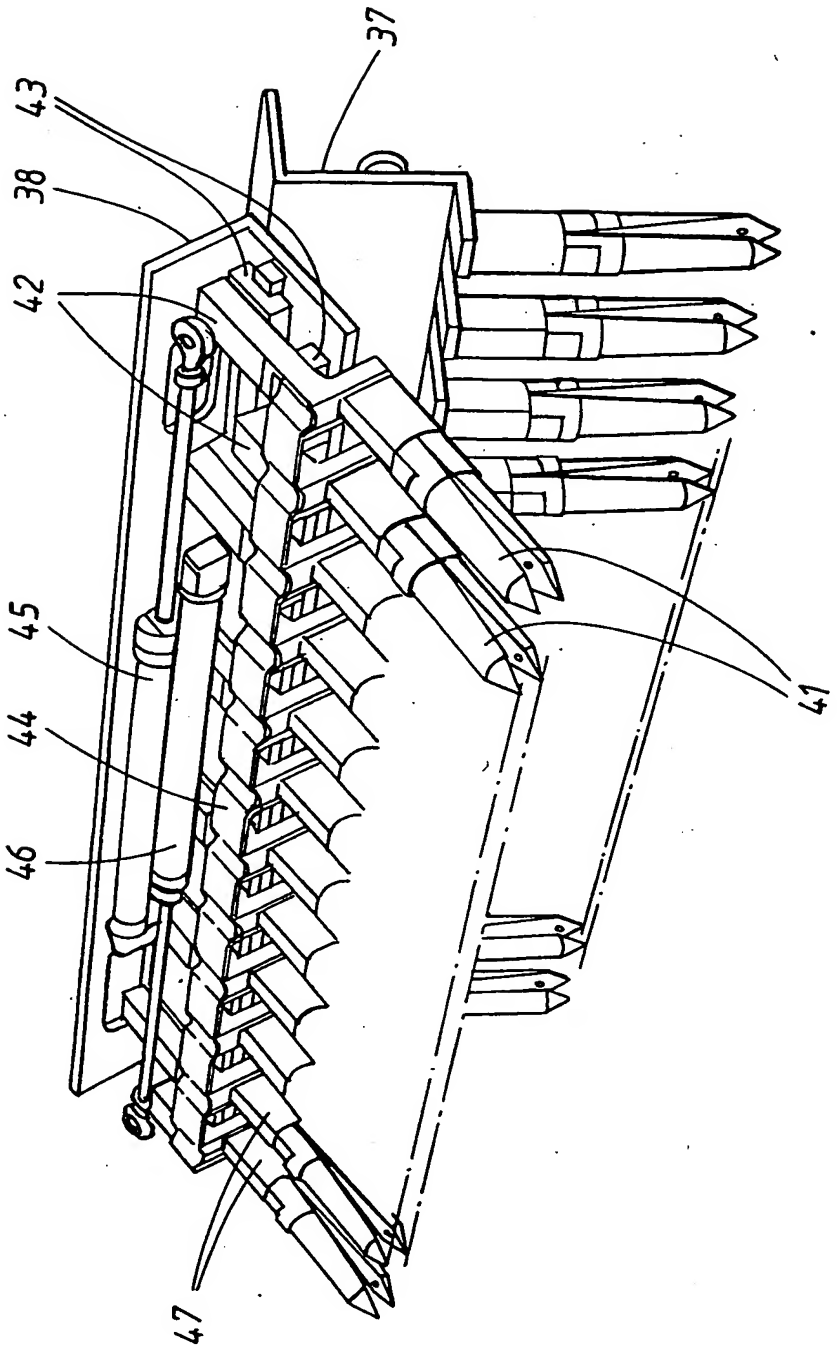

FIG.4

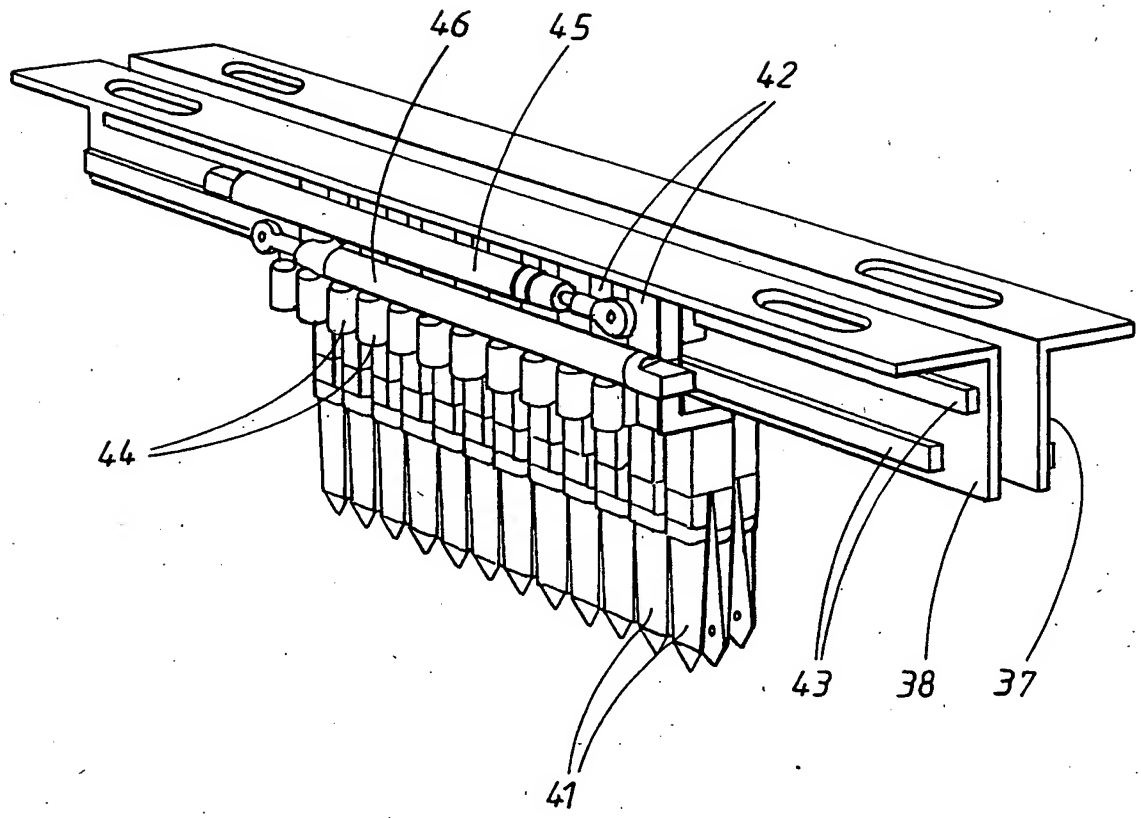

FIG.5

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER

IPC7: B65B 35/36
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: B65B, B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y	US 4901504 A (MIKIO TSUJI ET AL), 20 February 1990 (20.02.90), figures 10-13	1-5
A	US 4614073 A (IVO ARGAZZI), 30 Sept 1986 (30.09.86), figures 1-2	1-5
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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